

IAF SYMPOSIUM ON COMMERCIAL SPACEFLIGHT SAFETY ISSUES (D6)
Enabling safe commercial spaceflight: vehicles and spaceports (3)

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BLACK ARROW SHIP LAUNCH: ENABLING SAFETY FROM THE SEA

Abstract

The UK's emerging commercial satellite vehicles aim to launch payloads of up to 500kg in either a Sun-Synchronous Orbit or Polar Orbit. This limits the launch sites to the very North of Scotland in order to minimize the likelihood of harming the uninvolved public. Furthermore, a previous study concluded that the locations to the West of North Scotland have unfavourable 'Expected Casualty' analysis results due to population groups near to the SSO Polar Orbit trajectories, thereby leaving the Shetland Isles and Sutherland as potential launch sites. This paper discusses the alternate launch solutions; air-launch and sea-launch systems. The focus of the paper presents a sea-launch solution that not only provides flexibility in launch locations globally, but also argues that it provides a 'safer' option, both in terms of the 'ground' safety analysis and flight safety analysis. The land-locked spaceport/launcher ground safety analysis aims to ensure appropriate explosive siting safety distances are derived to protect the uninvolved public as well as keeping support/operations personnel safe. Additionally, the land-locked launcher's trajectory and associated flight safety analysis must ensure the collective risk per mission (to the uninvolved public), is acceptably low; this includes the near-pad blast hazard after launch as well as all points along the trajectory. However, a ship-launched solution removes the chance of harming the uninvolved public during the pre-flight and launch phases, being far from land. Additionally, the sea-launch position can be chosen with flexibility and optimised not only for orbit insertion but to ensure the flight safety analysis collective risk is extremely low. The paper also argues that 'enabling safe commercial spaceflight' of launch vehicles and spaceports involving separate commercial organisations can be complex and add to the risk (hazards also exist at the boundaries of responsibilities and these can sometimes be missed – or misinterpreted as to who owns the mitigation to said hazards e.g. is it the spaceport's responsibility or the spaceflight operator's responsibility). Hence a ship-launched solution is already a combined and effective solution in terms of design and operations with an embedded safety culture. A ship-launched Safety Management System will be implemented from the outset and a progressive safety case, from Concept, Design, Integration/Test and Operations will be the cornerstone of a successful launch license application. The paper also compares the ship-launch to the air-launch option.